LHCb Software Framework Efforts

M. Clemencic *on behalf of LHCb Collaboration*

October 23, 2019

CERN - LHCb

- LHCb Upgrade for Run3 requires significant changes to the code
- All LHCb efforts are targeting Run3

Table of contents

Multithreading and Algorithms

- Based on GaudiHive prototype
  - suffering from backward compatibility
- Working to convert all algorithms to Gaudi::Functional
  - algorithms as *pure* functions
    ```
    std::function<Output(const Input1&, const Input2&, …)>
    ```
  - constrain users to best practice boundaries
  - most of the details abstracted away
    Transient Event Store access, data dependencies, …
  - all algorithms are re-entrant

Scheduling

- LHCb position in the phase space:
  - small events
  - extremely tight time budget
- Overhead of Gaudi Avalanche Scheduler not acceptable
- We now have *HLTControlFlowMgr*

- One event per thread
  - serialized execution of Algorithms on each event
- Order of execution defined at configuration time
  - based on data and control flow dependencies
  - no need for intra-event synchronization
  - early exit from chains implemented as a *jump*
  - *barriers* implicit in the order of execution
- Optimization work in progress

Heterogeneous Resources (?)

- No actual plan
  - no pressure to use GPUs on HPCs
  - reconstruction workload tiny wrt simulation
  - we could profit from Geant4 on GPU

- No actual plan
  - no pressure to use GPUs on HPCs
  - reconstruction workload tiny wrt simulation
  - we could profit from Geant4 on GPU
- Trivial to implement asynchronous offloading
  - just store a `std::future` on the TES

Conclusions

- Work not completed yet
- Very confident on our path
- No plans for heterogeneous resources
  - but testing on various architectures